Comments on “Climate Change, Development, Poverty and Economics” by Sam Fankhauser and Nicolas Stern

June 7, 2016

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Outlines

1. A call for action *now*

2. New Climate Macro?
I. A call for action *now*

- Strong *warning*: economic damage caused by global warming might be considerably greater than current models predict.
I. A call for action now

- Strong **warning**: economic damage caused by global warming might be considerably greater than current models predict.

- More important than ever to take urgent and drastic action to curb climate change by reducing carbon emissions.
I. A call for action now

- **Strong warning**: economic damage caused by global warming might be considerably greater than current models predict.

- ⇒ more important than ever to take urgent and drastic action to curb climate change by reducing carbon emissions

Figure: Physical vulnerability to Climate Change (Guillaumont, AFD)
I. A call for action *now*

“Mitigation, adaptation and development are intertwined”
I. A call for action now

- "Mitigation, adaptation and development are intertwined"
- "The ‘horse-race’ between climate policy and development represents a false dichotomy".
I. A call for action *now*

- “Mitigation, adaptation and development are intertwined”
- “The ‘horse-race’ between climate policy and development represents a false dichotomy”.
- Systemic aspect of the SDGs.
I. A call for action *now*

- Urban planning in Porto Novo (Benin) or in the Phillipines [rising of sea level].
I. A call for action now

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- Building the thermic solar plant of Ouarzazate (Morocco) [Clean electrification]
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- Urban planning in Porto Novo (Benin) or in the Phillipines [rising of sea level].
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- Agro-ecological micro-projects in Zimbabwe [Clean agriculture]
I. A call for action *now*

- Urban planning in Porto Novo (Benin) or in the Phillipines [rising of sea level].
- Building the thermic solar plant of Ouarzazate (Morocco) [Clean electrification]
- Agro-ecological micro-projects in Zimbabwe [Clean agriculture]
- Sanitary programmes for children suffering from leptospirosis in the “Barquita” slums (Santo-Domingo) [Adaptation to droughts and typhoons]
I. A call for action now

- For low-income countries, *Adaptation* should be the priority.
I. A call for action *now*

- For low-income countries, *Adaptation* should be the priority.
- For emerging countries, *Mitigation* and *Adaptation* are equally important.

New Climate Economy Report.
I. A call for action *now*

- For low-income countries, *Adaptation* should be the priority.
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New Climate Economy Report.

- Funding strategies?
  The Green Fund... *Corridor* of carbon prices (COP21).
I. A call for action now

- For low-income countries, Adaptation should be the priority.
- For emerging countries, Mitigation and Adaptation are equally important. New Climate Economy Report.

- Funding strategies? The Green Fund... Corridor of carbon prices (COP21).
- IDFC has a specific role to play (possibly in connection with the Green Fund).
I. A call for action now

I. A call for action *now*

- Clever use of the **public guarantee** (Basu).
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- Recycling (already existing) **SDRs** ? (Giraud, Grandjean, Leguet (2015)).
I. A call for action now

- Clever use of the public guarantee (Basu).
- Recycling (already existing) SDRs? (Giraud, Grandjean, Leguet (2015)).
- **Green Securitization** (ECB...?)
  Climate Policy Initiative (CPI), I4CE.
I. A call for action now

"This is why we call for a radical deepening of economic analysis, including a development economics that begins to understand and incorporate climate change. Standard growth theory, general equilibrium and marginal methods will, as ever, have much to contribute but they will be nowhere near sufficient. This is about immense risks and radical change where time is of the essence. We should seek a dynamic economics where we tackle directly issues involving pace and scale of change in the context of major and systemic risks."
I. A call for action now

II. New Climate Macro?
II. New Climate Macro?

- **Modelling:**
  - The macroeconomics: Non-linear Dynamical System with debt dynamics.
  - The climate feed-back loop taken from Nordhaus’ DICE model (2013).

- **Estimation**
  - Calibration of the climate and public policy modules in line with Nordhaus’ DICE model (2013).
  - Macroeconomic module estimation at the world level (panel analysis for wider volatility).
II. New Climate Macro?

- **GEMMES** model (GEneral Monetary Macro-dynamics for the Ecological Shift).
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- Stock-flow Consistency
  Grasselli and Costa-Lima (2012)...

- Why is debt important for the issue at stake?
  - today’s liquidity trap due to debt overhang.
  - the (possibly huge) cost of investment in green infrastructures.
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- **GEMMES** model (GEneral Monetary Macro-dynamics for the Ecological Shift).

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- Public, private debt dynamics.
  **Debt-deflation** (Krugman and Eggertson (2012)).
  Financial sector (Giraud and Kockerols (2016)).
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- Non-neutral money + leverage cycle (Genakoplos).
II. New Climate Macro?

- Endogenous monetary business cycles.
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- Multiple long-run equilibria.
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- **Endogenous monetary business cycles.**
- Multiple long-run equilibria.
- **No Say’s law**
  Inventory dynamics.
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- Short-run Phillips curve (with delay) (Mankiw (2010)).
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- **No rational expectations.**
  - Phenomenological viewpoint: aggregate investment, consumption, Phillips functions are empirically estimated.
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  Inventory dynamics.
- Short-run Phillips curve (with delay) (Mankiw (2010)).
- No rational expectations.
  Phenomenological viewpoint : aggregate investment, consumption, Phillips functions are empirically estimated.
- Link between inequality and inefficiency + Stiglitz “stylized facts” on inequality.
  Giraud and Grasselli (2016).
II. New Climate Macro?

*Baseline Case - 1/2*

Figure: Exponential labor productivity growth (1.5% as in Nordhaus, 2013), quadratic damage (Nordhaus, 2013), sensitivity 2.9.
II. New Climate Macro?

Baseline Case - 2/2

Figure: Exponential labor productivity growth (1.5% as in Nordhaus, 2013), quadratic damage (Nordhaus, 2013), sensitivity 2.9.
II. New Climate Macro?

*Baseline Case - Key values*

<table>
<thead>
<tr>
<th>Key Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP Real Growth 2100 (wrt 2010)</td>
<td>462%</td>
</tr>
<tr>
<td>t CO₂ per capita (2050)</td>
<td>5.6</td>
</tr>
<tr>
<td>Temperature change in 2100</td>
<td>+4.95 °C</td>
</tr>
<tr>
<td>Carbon price (ton of CO₂ in $ 2005)</td>
<td>2.22</td>
</tr>
<tr>
<td>CO₂ concentration 2100</td>
<td>732.8 ppm</td>
</tr>
</tbody>
</table>

*Table*: Key values of the simulation.
II. New Climate Macro?

Degrowth - 1/2

Figure: Endogenous labor productivity depending on temperature (Burke and al., 2015, *Nature*), quadratic damage (Nordhaus, 2013), sensitivity 2.9.
II. New Climate Macro?

Degrowth - 2/2

Figure: Endogenous labor productivity depending on temperature (Burke and al., 2015), quadratic damage (Nordhaus, 2013), sensitivity 2.9.
II. New Climate Macro?

*Degrowth - Key values*

- GDP Real Growth 2100 (wrt 2010): 225%
- $\text{t CO}_2$ per capita in 2050: 5.9 t
- Temperature change in 2100: +4.92 °C
- Carbon price (ton of CO$_2$ in $2005$) in 2050: 2.22
- CO$_2$ concentration in 2100: 681.5 ppm

**Table**: Key values of the simulation.
II. New Climate Macro?

Collapse - 1/2

Figure: Endogenous labor productivity depending on temperature (Burke and al., 2015, *Nature*), polynomial damage (Dietz and Stern, 2015), sensitivity 2.9.
II. New Climate Macro?

*Collapse - 2/2*

**Figure**: Endogenous labor productivity depending on temperature (Burke and al., 2015, *Nature*), polynomial damage (Dietz and Stern, 2015), sensitivity 2.9.
II. New Climate Macro?

*Collapse - Key values*

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<tr>
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<tbody>
<tr>
<td>GDP Real Growth 2100 (wrt 2010)</td>
<td>−34.65%</td>
</tr>
<tr>
<td>t CO₂ per capita</td>
<td>5.6</td>
</tr>
<tr>
<td>Temperature change in 2100</td>
<td>+4.62 °C</td>
</tr>
<tr>
<td>Carbon price (ton of CO₂ in $ 2005)</td>
<td>2.22</td>
</tr>
<tr>
<td>CO₂ concentration 2100</td>
<td>575.3 ppm</td>
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II. New Climate Macro?

*Collapse - Carbon Price - S=2.9 - 2/3*

Figure: Endogenous labor productivity depending on temperature (Burke and al., 2015), polynomial damage (Dietz and Stern, 2015), sensitivity 2.9.
II. New Climate Macro?

*Collapse - Carbon Price - S=2.9 - 3/3*

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**Figure**: Endogenous labor productivity depending on temperature (Burke and al., 2015) and a polynomial damage (Dietz and Stern, 2015), sensitivity 2.9.
II. New Climate Macro?

*Collapse - Carbon Price - S=2.9 - Key values*

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
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<tbody>
<tr>
<td>GDP Real Growth 2100 (wrt 2010)</td>
<td>316%</td>
</tr>
<tr>
<td>t CO₂ per capita in 2050</td>
<td>5.54</td>
</tr>
<tr>
<td>Temperature change in 2100</td>
<td>+3.21 °C</td>
</tr>
<tr>
<td>Carbon price (ton of CO₂ in $ 2005) in 2050</td>
<td>26</td>
</tr>
<tr>
<td>CO₂ concentration 2100</td>
<td>641.2 ppm</td>
</tr>
</tbody>
</table>

*Table: Key values of the simulation.*
II. New Climate Macro?

*Collapse - Carbon Price - S=6 - 2/3*

Figure: Endogenous labor productivity depending on temperature (Burke and al., 2015), polynomial damage (Dietz and Stern, 2015), *sensitivity 6.*
II. New Climate Macro?

Collapse - Carbon Price - \( S=6 \) - 3/3

Figure: Endogenous labor productivity depending on temperature (Burke and al., 2015), polynomial damage (Dietz and Stern, 2015), sensitivity 6.
II. New Climate Macro?

*Collapse - Carbon Price - S=6 - Key values*

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
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<tbody>
<tr>
<td>GDP Real Growth 2100 (wrt 2010)</td>
<td>−9.1%</td>
</tr>
<tr>
<td>t CO$_2$ per capita in 2050</td>
<td>5.04</td>
</tr>
<tr>
<td>Temperature change in 2100</td>
<td>+4.45 °C</td>
</tr>
<tr>
<td>Carbon price (ton of CO$_2$ in $ 2005) in 2050</td>
<td>26</td>
</tr>
<tr>
<td>CO$_2$ concentration 2100</td>
<td>549.6 ppm</td>
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II. New Climate Macro?

_Collapse avoided - Carbon Price 2 - S=6 - 1/3_

The following scenario includes the carbon price _à la_ Dietz and Stern (2015) and a Weitzman damage, with a climate sensitivity of 6. Translated in $2005 \text{ t/CO}_2$ price, the carbon value in 2015 is $74 and $306 in 2055. The collapse is avoided.
II. New Climate Macro?

Collapse avoided - Carbon Price 2 - $S=6 - 2/3$

**Figure:** Endogenous labor productivity depending on temperature (Burke and al., 2015), polynomial damage (Dietz and Stern, 2015), sensitivity 6.
II. New Climate Macro?

Collapse avoided - Carbon Price 2 - S=6 - 3/3

Figure: Endogenous labor productivity depending on temperature (Burke and al., 2015) and a polynomial damage (Dietz and Stern, 2015).
II. New Climate Macro?

*Collapse avoided- Carbon Price 2 - S=6 - Key values*

<table>
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<th>Parameter</th>
<th>Value</th>
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<tr>
<td>GDP Real Growth 2100 (wrt 2010)</td>
<td>272%</td>
</tr>
<tr>
<td>t CO₂ per capita in 2050</td>
<td>0.70</td>
</tr>
<tr>
<td>Temperature change in 2100</td>
<td>+3.23 °C</td>
</tr>
<tr>
<td>Carbon price (ton of CO₂ in $ 2005) in 2050</td>
<td>256</td>
</tr>
<tr>
<td>CO₂ concentration ppm in 2100</td>
<td>395.71 ppm</td>
</tr>
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**Table**: Key values of the simulation.

According to this model, a carbon price near $\$(2005)938/tC is needed in 2050 to avoid the collapse.
développeur d'avenirs durables